As determined from the polymerization/glgC assay,

These parameters will be the governing parameters for the efficiency of making glucose into glycogen of our device for now.

A recent study ([Nikola Sakač and Milan Sak-Bosnar, 2012](http://www.electrochemsci.org/papers/vol7/7043008.pdf)) reported that the Vmax and Km of alpha-amylase were determined to be Vmax = 3.31E-05M/min and Km = 0.5771 mg starch/mL. [Assume the molecular weight of soluble starch is 342.30](http://www.sigmaaldrich.com/catalog/product/sial/s9765?lang=en&region=US) Then it becomes Km = 1.686 mM.

Assume that once the oral dose reaches small intestine, it is distributed instantaneously and homogenously. Then let’s consider the following 2-compartment model:

Small intestine

Kamyl

Ke

Blood Plasma

Oral dose (Glucose)

Glucose Glycogen

KglgC

**Figure 1. Schematic of a one-compartment model.**

Because theoretically no significant lysis of cells happen before 2 hrs, we have the following equations:

Assume the absorption of glucose by small intestine, ke, is a zero-order reaction. When t<2, the equation (1) simplifies into:

Plug (3) into (5),

When t>=2, the equation (1) simplifies into:

Plug (3) into (5),

And we have

Where the volume of the compartment is 188 mL and as defined in the model. Thus the equations become,

When t < 2 hrs;

, when t >= 2 hrs.

Now suppose a patient orally take 78 mg glucose, which is a pretty standard amount for glucose-response study.

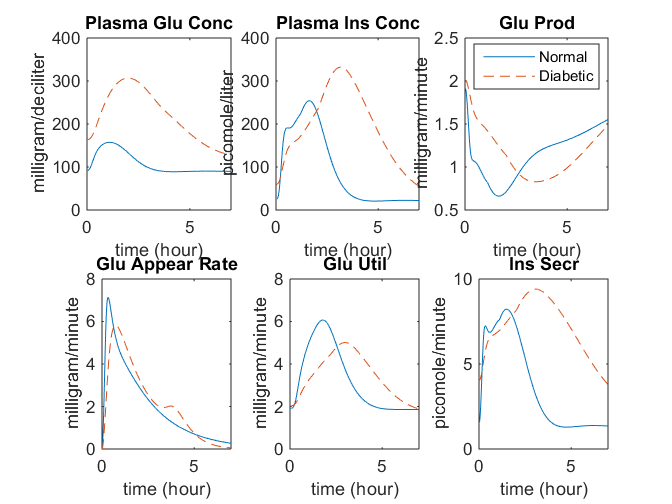
Then

Current probiotics medicine usually include 100 mg – 1000 mg dry weight of probiotics in one serving, if we load 300 mg of dry cells into one capsule, 1000 mg/150 fg(the weight of single E. coli cell) = 7x10^12 cells. 7x10^12/(2.4x10^8) is about 31000.

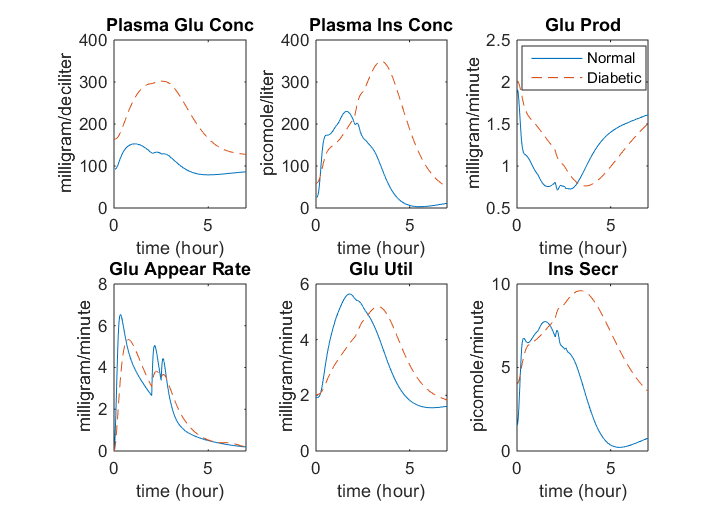
Then the first equation becomes

When t < 2 hrs;

Using the Matlab SimBiology toolbox, we simulated the glucose response of normal people and diabetic patients.



**Figure 2. Glucose response without our device.** A single oral dose of 78 mg glucose is administrated at time zero. The panel shows glucose and insulin concentration in the plasma, glucose appearance rate and duration of glucose utilization and insulin secretion.



**Figure 3. Glucose response pattern with our device.** A single oral dose of 78 mg glucose is administrated at time zero. But the glycemic effect is mitigated because the glucose is taken up by the cells. We need to point out that the normal subjects respond to our device better than diabetic patients. Optimization of this simulating method should be developed to better grasp the theoretical responses.